# Improving Instructional Practices in Mathematics

Joan Ferrini-Mundy

Division of Research on Learning in Formal and Informal Settings

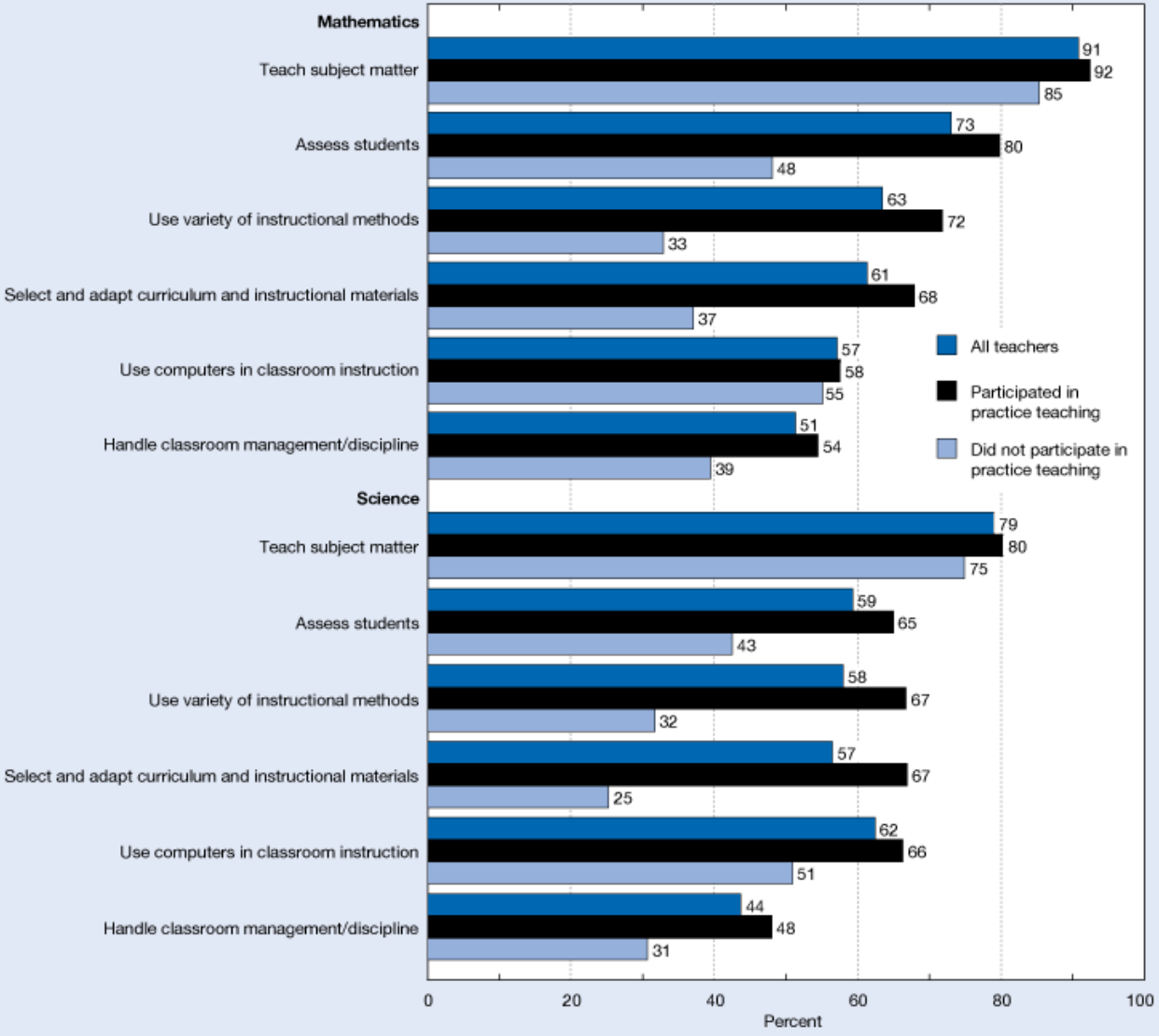
National Science Foundation

*Mathematics Success in Title I Schools: Lessons Learned from the National Math Panel Report*

Baltimore, May 15, 2008

What does research tell us about which instructional practices will enable students to learn mathematics well?

Figure 1-11
**Preparedness for first-year teaching of public middle and high school mathematics and science teachers with less than 5 years of experience, by participation in practice teaching: Academic year 2003–04**




NOTES: Teachers with <5 years of teaching experience asked about how well they were prepared to perform various tasks during first year of teaching. Response categories included "very well prepared," "well prepared," "somewhat prepared," and "not at all prepared." Percentages based on teachers who responded "very well prepared" or "well prepared."

SOURCES: National Center for Education Statistics, Schools and Staffing Survey, 2003–04; and National Science Foundation, Division of Science Resources Statistics, special tabulations.

*Science and Engineering Indicators 2008*

# Beginning teachers' preparedness in various instructional practices

To prepare students for Algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, factual knowledge and problem solving skills… *Teachers should emphasize these interrelations.*

*NMP Final Report, p. xix.*

Instructional practice should be informed by high quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers.

*NMP Final Report, p. xiv*

# Issues addressed by NMP Instructional Practices Task Group

- Teacher-directed and student-centered instruction
- Cooperative learning and peer tutoring
- Instruction for students with learning challenges
- "Real-world" problem solving
- The role of technology
- The gifted student
- Use of formative assessment

# Issues for today:

- Teacher-directed and student-centered instruction
- Cooperative learning and peer tutoring
- Instruction for students with learning challenges
- "Real-world" problem solving
- The role of technology
- The gifted student
- Use of formative assessment

**Student-centered instruction:** primarily students are doing the teaching and the majority of the interactions about the mathematics occur between and among students.

**Teacher-directed instruction:** primarily the teacher is communicating the mathematics to the students directly, and the majority of the interactions about the mathematics are between the teacher and the student.

All-encompassing recommendations that instruction should be student-centered or teacher-directed are not supported by research. High-quality research does not support the exclusive use of either approach.

- Peer-to-peer learning: structured activities for students working in pairs
- Cooperative learning: more general strategies for tutoring, enrichment and remediation, substitute for independent seatwork, extension activities, etc.

# Findings

- It appears that peer-tutoring strategies may be promising in teaching young children mathematical operations
- The implementation of Team- Assisted Individualization (TAI) for students in grades 3-6, in comparison to a form of whole class instruction, benefits computation skills.

# Students with learning challenges

- Between 5 and 10% of students will experience a serious learning disability in mathematics before completing high school; many others will have difficulty in learning mathematics
  - Students with learning disabilities
  - Students with low achievement

# Teaching low-achieving students and students with disabilities:

Research on students who are low achievers, have difficulties in mathematics, or have learning disabilities related to mathematics tells us that the effective practices include:

- Some explicit systematic instruction available on a regular basis
- Clear models for solving particular problem types
- Carefully orchestrated examples/ sequences of examples
- Concrete objects to understand abstract representations and notation
- Opportunities to ask and answer questions and think aloud

# Formative Assessment

- Ongoing monitoring of student learning to inform instruction to provide feedback about progress
- Used to determine whether specific students (or entire class) require additional instruction to learn concepts or develop proficiency
- From the school psychology/educational psychology traditions

# Using Formative Assessment

Formative assessment enhances mathematics achievement, particularly when:

- Information is used to determine focus of instruction
- Expert teachers offer advice
- Computer-assisted instruction or peer tutoring is a component

The Panel recommends regular use of formative assessment, particularly for students in the elementary grades.

# Enhancements to assessments:

- Detailed analyses indicating strengths and weaknesses provided to teachers
- Using assessment data and software to provide specific instructional suggestions for specific students
- Using data as basis for peer-assisted learning
- Using data as basis of consultation between classroom teacher and special educator
- Self monitoring for teacher
- Use of data for teacher to provide specific suggestions for small group instruction and CAI

# For More Information

http://www.ed.gov/MathPanel

Report of the Task Group on Instructional Practices

jferrini@nsf.gov